

APPLICATION FOR FEDERAL ASSISTANCE
SF 424 (R&R)

1. TYPE OF SUBMISSION <input type="checkbox"/> Pre-application <input checked="" type="checkbox"/> Application <input type="checkbox"/> Changed/Corrected Application		3. DATE RECEIVED BY STATE <input type="text"/>	State Application Identifier <input type="text"/>
2. DATE SUBMITTED <input type="text" value="11/15/2022"/>	Applicant Identifier <input type="text" value="13682"/>	4. a. Federal Identifier <input type="text" value="N00014"/>	b. Agency Routing Identifier <input type="text" value="341 [Steinhauser, Natalie]"/>
		c. Previous Grants.gov Tracking ID <input type="text"/>	
5. APPLICANT INFORMATION Legal Name: <input type="text" value="The University of Texas at San Antonio"/> Department: <input type="text"/> Division: <input type="text"/> Street1: <input type="text" value="One UTSA Circle"/> Street2: <input type="text"/> City: <input type="text" value="San Antonio"/> County / Parish: <input type="text" value="Bexar"/> State: <input type="text" value="TX: Texas"/> Province: <input type="text"/> Country: <input type="text" value="USA: UNITED STATES"/> ZIP / Postal Code: <input type="text" value="78249-1644"/> UEI: <input type="text" value="U44ZMVYU52U6"/> Person to be contacted on matters involving this application Prefix: <input type="text"/> First Name: <input type="text" value="Liana"/> Middle Name: <input type="text"/> Last Name: <input type="text" value="Ryan"/> Suffix: <input type="text"/> Position/Title: <input type="text" value="Director, Research Service Center"/> Street1: <input type="text" value="One UTSA Circle"/> Street2: <input type="text"/> City: <input type="text" value="San Antonio"/> County / Parish: <input type="text" value="Bexar"/> State: <input type="text" value="TX: Texas"/> Province: <input type="text"/> Country: <input type="text" value="USA: UNITED STATES"/> ZIP / Postal Code: <input type="text" value="78249-1644"/> Phone Number: <input type="text" value="2104586472"/> Fax Number: <input type="text" value="2104585196"/> Email: <input type="text" value="LIANA.RYAN@UTSA.EDU"/>			
6. EMPLOYER IDENTIFICATION (EIN) or (TIN): <input type="text" value="741717115"/>			
7. TYPE OF APPLICANT: <input type="text" value="S: Hispanic-serving Institution"/> Other (Specify): <input type="text"/> Small Business Organization Type <input type="checkbox"/> Women Owned <input type="checkbox"/> Socially and Economically Disadvantaged			
8. TYPE OF APPLICATION: <input checked="" type="checkbox"/> New <input type="checkbox"/> Resubmission <input type="checkbox"/> Renewal <input type="checkbox"/> Continuation <input type="checkbox"/> Revision		If Revision, mark appropriate box(es). <input type="checkbox"/> A. Increase Award <input type="checkbox"/> B. Decrease Award <input type="checkbox"/> C. Increase Duration <input type="checkbox"/> D. Decrease Duration <input type="checkbox"/> E. Other (specify): <input type="text"/>	
Is this application being submitted to other agencies? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> What other Agencies? <input type="text"/>			
9. NAME OF FEDERAL AGENCY: <input type="text" value="Office of Naval Research"/>		10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: <input type="text" value="12.330"/> TITLE: <input type="text" value="Science, Technology, Engineering & Mathematics (STEM) Education, Outreach and Workforce Program"/>	
11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT: <input type="text" value="An Active Learning Approach for Inclusive and Diverse Workforce in Autonomy and Artificial Intelligence"/>			
12. PROPOSED PROJECT: Start Date <input type="text" value="05/01/2023"/> Ending Date <input type="text" value="04/30/2026"/>		13. CONGRESSIONAL DISTRICT OF APPLICANT <input type="text" value="TX-020"/>	

14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix: First Name: Middle Name:

Last Name: Suffix:

Position/Title:

Organization Name:

Department:

Division:

Street1:

Street2:

City: County / Parish:

State: Province:

Country: ZIP / Postal Code:

Phone Number: Fax Number:

Email:

15. ESTIMATED PROJECT FUNDING

a. Total Federal Funds Requested	<input type="text" value="461,730.00"/>
b. Total Non-Federal Funds	<input type="text" value="0.00"/>
c. Total Federal & Non-Federal Funds	<input type="text" value="461,730.00"/>
d. Estimated Program Income	<input type="text" value="0.00"/>

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES ☐ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE:

b. NO ☒ PROGRAM IS NOT COVERED BY E.O. 12372; OR
☐ PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. By signing this application, I certify (1) to the statements contained in the list of certifications* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances* and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

☒ I agree

*The list of certifications and assurances, or an Internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

18. SFLLL (Disclosure of Lobbying Activities) or other Explanatory Documentation

19. Authorized Representative

Prefix: First Name: Middle Name:

Last Name: Suffix:

Position/Title:

Organization:

Department:

Division:

Street1:

Street2:

City: County / Parish:

State: Province:

Country: ZIP / Postal Code:

Phone Number: Fax Number:

Email:

Signature of Authorized Representative

Date Signed

Liana Ryan

11/15/2022

20. Pre-application

21. Cover Letter Attachment

RESEARCH & RELATED Other Project Information

OMB Number: 4040-0001
Expiration Date: 12/31/2022

1. Are Human Subjects Involved? ☐ Yes ☒ No

1.a. If YES to Human Subjects

Is the Project Exempt from Federal regulations? ☐ Yes ☐ No

If yes, check appropriate exemption number. ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

If no, is the IRB review Pending? ☐ Yes ☐ No

IRB Approval Date:

Human Subject Assurance Number:

2. Are Vertebrate Animals Used? ☐ Yes ☒ No

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending? ☐ Yes ☐ No

IACUC Approval Date:

Animal Welfare Assurance Number:

3. Is proprietary/privileged information included in the application? ☐ Yes ☒ No

4.a. Does this Project Have an Actual or Potential Impact - positive or negative - on the environment? ☐ Yes ☒ No

4.b. If yes, please explain:

4.c. If this project has an actual or potential impact on the environment, has an exemption been authorized or an environmental assessment (EA) or environmental impact statement (EIS) been performed? ☐ Yes ☐ No

4.d. If yes, please explain:

5. Is the research performance site designated, or eligible to be designated, as a historic place? ☐ Yes ☒ No

5.a. If yes, please explain:

6. Does this project involve activities outside of the United States or partnerships with international collaborators? ☐ Yes ☒ No

6.a. If yes, identify countries:

6.b. Optional Explanation:

7. Project Summary/Abstract

8. Project Narrative

9. Bibliography & References Cited

10. Facilities & Other Resources

11. Equipment

12. Other Attachments ☐

Project Abstract Summary

This Project Abstract Summary form must be submitted or the application will be considered incomplete. Ensure the Project Abstract field succinctly describes the project in plain language that the public can understand and use without the full proposal. Use 4,000 characters or less. Do not include personally identifiable, sensitive or proprietary information. Refer to Agency instructions for any additional Project Abstract field requirements. If the application is funded, your project abstract information (as submitted) will be made available to public websites and/or databases including USAspending.gov.

Funding Opportunity Number

N00014-22-S-F006

CFDA(s)

12.330

Applicant Name

The University of Texas at San Antonio

Descriptive Title of Applicant's Project

An Active Learning Approach for Inclusive and Diverse Workforce in Autonomy and Artificial Intelligence

Project Abstract

Maintaining and cultivating a diverse, world-class Science, Technology, Engineering and Mathematics (STEM) workforce is critical for maintaining the superiority of the United States Navy and beyond. One important limitation of the existing STEM education approaches is the lack of balancing the need for broad technical skills and essential human teaming dynamics/effectiveness skills, which are two fundamental components in workforce development, especially in the area of autonomy and artificial intelligence (AI). One key challenge is the development of appropriate platforms to train/educate students with rich hands-on STEM topics in autonomy and AI. Another key challenge is to expose students with different and real-world human teaming dynamics/effectiveness experiences. The goals of the project are to overcome the two challenges via developing a new active learning STEM education approach that promotes self-motivated and self-managed active technical skill and teaming skill development through learning from internships, lab projects, and competitions. Specifically, the project will focus on three essential thrusts: (1) Diverse Hands-on STEM Topics: build students' rich hands-on skills to improve their technology awareness; (2) Human Teaming Effectiveness/Interaction topics: create an active learning environment for students to learn, apply, adapt, and optimize their teaming skills towards teaming awareness; (3) Testing, Evaluation, and Board Impacts: Test, evaluate, and improve the active learning STEM education approach for broader impacts via participation in competitions and students' internships/jobs in national labs and industrial companies. In short term, the project seeks to create a more efficient active learning STEM education approach that balances the needs for technical skill development and human teaming effectiveness development. In long term, the proposed STEM activities aim to provide some fundamental guidelines and principles for a sustainable and scalable engineering workforce pipeline, which are critical for future Navy and DoD missions.

Approved for Public Release

RESEARCH & RELATED BUDGET - Budget Period 1

OMB Number: 4040-0001

Expiration Date: 12/31/2022

UEI: U44ZMVYU52U6

Enter name of Organization: The University of Texas at San Antonio

Budget Type: ☒ Project ☐ Subaward/Consortium

Budget Period: 1

Start Date: 05/01/2023

End Date: 04/30/2024

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
Dr.	Yongcan		Cao		(b) (4)			1.00	(b) (4)		15,575.00

Project Role: PD/PI

Additional Senior Key Persons:

Add Attachment

Delete Attachment

View Attachment

Total Funds requested for all Senior Key Persons in the attached file

Total Senior/Key Person

15,575.00

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
	Post Doctoral Associates						
1	Graduate Students	3.00				(b) (4)	16,200.00
3	Undergraduate Students	13.50				(b) (4)	48,600.00
	Secretarial/Clerical					(b) (4)	
2	High School Students	5.54				(b) (4)	13,478.00
6	Total Number Other Personnel					Total Other Personnel	78,278.00

Total Salary, Wages and Fringe Benefits (A+B)

93,853.00

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item

Funds Requested (\$)

Additional Equipment:

Add Attachment

Delete Attachment

View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

		Funds Requested (\$)
1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	4,000.00
2.	Foreign Travel Costs	
Total Travel Cost		4,000.00

E. Participant/Trainee Support Costs

		Funds Requested (\$)
1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees	Total Participant/Trainee Support Costs

F. Other Direct Costs		Funds Requested (\$)
1. Materials and Supplies		1,937.00
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		

Total Other Direct Costs 1,937.00

G. Direct Costs	Funds Requested (\$)
Total Direct Costs (A thru F)	99,790.00

H. Indirect Costs				Funds Requested (\$)
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)		
Organized Research MTDC	(b) (4)			
Total Indirect Costs				(b) (4)

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

DHHS, Theodore Foster, 214-767-3261

I. Total Direct and Indirect Costs	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	149,685.00

J. Fee	Funds Requested (\$)

K. Total Costs and Fee	Funds Requested (\$)
Total Costs and Fee (I + J)	149,685.00

L. Budget Justification

(Only attach one file.)

Budget_Justification_11_141028948711.p

Add Attachment

Delete Attachment

View Attachment

RESEARCH & RELATED BUDGET - Budget Period 2

OMB Number: 4040-0001

Expiration Date: 12/31/2022

UEI: U44ZMVYU52U6

Enter name of Organization: The University of Texas at San Antonio

Budget Type: ☒ Project ☐ Subaward/Consortium

Budget Period: 2

Start Date: 05/01/2024

End Date: 04/30/2025

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
Dr.	Yongcan		Cao		(b) (4)			1.00	(b) (4)		16,015.00
Project Role: PD/PI											

Additional Senior Key Persons:

Add Attachment

Delete Attachment

View Attachment

Total Funds requested for all Senior Key Persons in the attached file

Total Senior/Key Person

16,015.00

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
	Post Doctoral Associates						
1	Graduate Students	3.00			(b) (4)		16,686.00
3	Undergraduate Students	13.50			(b) (4)		50,058.00
	Secretarial/Clerical				(b) (4)		
2	High School Students	5.54			(b) (4)		13,882.00
6	Total Number Other Personnel					Total Other Personnel	80,626.00

Total Salary, Wages and Fringe Benefits (A+B)

96,641.00

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item

Funds Requested (\$)

Additional Equipment:

Add Attachment

Delete Attachment

View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

		Funds Requested (\$)
1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	4,000.00
2.	Foreign Travel Costs	
Total Travel Cost		4,000.00

E. Participant/Trainee Support Costs

		Funds Requested (\$)
1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	<div></div>	
<div></div>	Number of Participants/Trainees	Total Participant/Trainee Support Costs

F. Other Direct Costs		Funds Requested (\$)
1. Materials and Supplies		1,937.00
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
Total Other Direct Costs		1,937.00

G. Direct Costs	Funds Requested (\$)
Total Direct Costs (A thru F)	102,578.00

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Organized Research MTDC	(b) (4)		
Total Indirect Costs			(b) (4)

Cognizant Federal Agency (Agency Name, POC Name, and POC Phone Number)	DHHS, Theodore Foster, 214-767-3261
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I. Total Direct and Indirect Costs	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	153,868.00

J. Fee	Funds Requested (\$)

K. Total Costs and Fee	Funds Requested (\$)
Total Costs and Fee (I + J)	153,868.00

L. Budget Justification			
(Only attach one file.)	Budget_Justification_11_141028948711.p	Add Attachment	Delete Attachment
			View Attachment

RESEARCH & RELATED BUDGET - Budget Period 3

OMB Number: 4040-0001
Expiration Date: 12/31/2022

UEI: U44ZMVYU52U6

Enter name of Organization: The University of Texas at San Antonio

Budget Type: ☒ Project ☐ Subaward/Consortium

Budget Period: 3

Start Date: 05/01/2025

End Date: 04/30/2026

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
Dr.	Yongcan		Cao		(b) (4)			1.00	(b) (4)		16,468.00
Project Role: PD/PI											

Additional Senior Key Persons:

Add Attachment

Delete Attachment

View Attachment

Total Funds requested for all Senior Key Persons in the attached file

Total Senior/Key Person

16,468.00

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
	Post Doctoral Associates						
1	Graduate Students	3.00				(b) (4)	17,187.00
3	Undergraduate Students	13.50				(b) (4)	51,561.00
	Secretarial/Clerical					(b) (4)	
1	High School Students	5.54				(b) (4)	14,298.00
5	Total Number Other Personnel					Total Other Personnel	83,046.00
Total Salary, Wages and Fringe Benefits (A+B)							99,514.00

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)

Additional Equipment:

Add Attachment

Delete Attachment

View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

		Funds Requested (\$)
1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	4,000.00
2.	Foreign Travel Costs	
Total Travel Cost		4,000.00

E. Participant/Trainee Support Costs

		Funds Requested (\$)
1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees	Total Participant/Trainee Support Costs

F. Other Direct Costs		Funds Requested (\$)
1. Materials and Supplies		1,937.00
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		

Total Other Direct Costs 1,937.00

G. Direct Costs	Funds Requested (\$)
Total Direct Costs (A thru F)	(b) (4)

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Organized Research MTDC	(b) (4)		
Total Indirect Costs			(b) (4)

Cognizant Federal Agency	
(Agency Name, POC Name, and POC Phone Number)	DHHS, Theodore Foster, 214-767-3261

I. Total Direct and Indirect Costs	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	158,177.00

J. Fee	Funds Requested (\$)

K. Total Costs and Fee	Funds Requested (\$)
Total Costs and Fee (I + J)	158,177.00

L. Budget Justification			
(Only attach one file.)	Budget_Justification_11_141028948711.p	Add Attachment	Delete Attachment
			View Attachment

RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals (\$)
Section A, Senior/Key Person		48,058.00
Section B, Other Personnel		241,950.00
Total Number Other Personnel	17	
Total Salary, Wages and Fringe Benefits (A+B)		290,008.00
Section C, Equipment		
Section D, Travel		12,000.00
1. Domestic	12,000.00	
2. Foreign		
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		5,811.00
1. Materials and Supplies	5,811.00	
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
11. Other 4		
12. Other 5		
13. Other 6		
14. Other 7		
15. Other 8		
16. Other 9		
17. Other 10		

Section G, Direct Costs (A thru F)

307,819.00

Section H, Indirect Costs

(b) (4)

Section I, Total Direct and Indirect Costs (G + H)

461,730.00

Section J, Fee

Section K, Total Costs and Fee (I + J)

461,730.00

RESEARCH & RELATED Senior/Key Person Profile (Expanded)

PROFILE - Project Director/Principal Investigator			
Prefix:	Dr.	* First Name:	Yongcan
		Middle Name:	
* Last Name:	Cao	Suffix:	
Position/Title:	ASSOCIATE PROFESSOR		
Department:	CEID ELEC & COMP ENGINEERING		
Organization Name:	The University of Texas at San Antonio		
Division:	VP OF ACADEMIC AFFAIRS		
* Street1:	13814 Bent Ridge Dr		
Street2:			
* City:	San Antonio	County/ Parish:	Bexar
* State:	TX: Texas	Province:	
* Country:	USA: UNITED STATES	* Zip / Postal Code:	78249-1644
* Phone Number:	2104586269	Fax Number:	+12104585947
* E-Mail:	YONGCAN.CAO@UTSA.EDU		
Credential, e.g., agency login:	yongcan		
* Project Role:	PD/PI	Other Project Role Category:	
Degree Type:	Ph.D.		
Degree Year:	2010		
* Attach Biographical Sketch	Cao_biosketch1028948670.pdf	Add Attachment	Delete Attachment View Attachment
Attach Current & Pending Support	C_P_STEM_CAO_vf1028948669.pdf	Add Attachment	Delete Attachment View Attachment

PROFILE - Senior/Key Person 1			
Prefix:		* First Name:	
		Middle Name:	
* Last Name:		Suffix:	
Position/Title:			
Department:			
Organization Name:			
Division:			
* Street1:			
Street2:			
* City:		County/ Parish:	
* State:		Province:	
* Country:	USA: UNITED STATES	* Zip / Postal Code:	
* Phone Number:		Fax Number:	
* E-Mail:			
Credential, e.g., agency login:			
* Project Role:		Other Project Role Category:	
Degree Type:			
Degree Year:			
Attach Biographical Sketch		Add Attachment	Delete Attachment View Attachment
Attach Current & Pending Support		Add Attachment	Delete Attachment View Attachment

Budget Justification

We propose to carry out this project from May 1, 2023 through April 30, 2026. We request a grand total amount of \$461,730 for this project.

Total cost by year:

Year 1: \$149,685

Year 2: \$153,868

Year 3: \$158,177

a. Senior Personnel

Dr. Yongcan Cao, PI (1-person month), will be responsible for day to day operation of the project. He will work closely the administrative staff for recruiting students, collecting data and preparing reports. He will be responsible for identifying the proper project tasks and managing project progress for each student. Additionally, he will be responsible for interactions with the Navy for annual report submission. The funds requested include a 3% increase for years 2 and 3.

Year 1: \$12,435

Year 2: \$12,808

Year 3: \$13,192

b. Other Personnel

One Graduate Student, 3 Undergraduate Students, 2 High-School Students

\$72,480 is requested for year 1 to provide supports for one graduate student (3 months effort/year), 3 undergraduate students (4.5 months effort/year), and 2 high-school students (2.77 months effort/year). The graduate student will be trained on hands-on skills on drone design, software, user interface, and drone operation while offering training to undergraduate and high-school students on AI, autonomy, and machine learning algorithms. The undergraduate students will work on new modules for our new drone platform, software/hardware development, interface design, and machine learning algorithm implementation and testing, training of high-school students. The high-school students will be trained on practical hands-on skills on CAD design, 3D printing, drone assembly, drone flight, and basic testing and data analysis. There is a 3% increase for years 2 and 3.

Year 1: \$72,480

Year 2: \$74,654

Year 3: \$76,894

Fringe Benefits

Fringe benefits for faculty and staff at UTSA are calculated based on salaries at a rate of (b) (4) plus an additional percentage for premium sharing (medical insurance), which varies based on coverage type (rate table is provided below and further detail is available at the link below).

Fringe benefits for students are calculated based on salaries/wages at a rate of (b) (4). Additional detail can be found here: <https://www.utsa.edu/financialaffairs/services/payroll/faculty-staff-resources/fringe-benefits.html>, and is available at the end of this document.

Year 1: (b) (4)

Year 2: (b) (4)

Year 3: (b) (4)

c. Equipment

None

d. Travel

A total of \$12,000 (\$4,000 per year) is budgeted for travel. Itemized costs are shown below and comply with GSA rates.

- \$4,000 per year for the PI and one student to travel to a national conference on robotics, automation, and artificial intelligence. The purpose of the trip to a national conference is to disseminate the results and interact with other educators/researchers in the same field in order to learn about the best practices.

\$500/person	Airfare
\$600/person	Lodging (\$200/night x 3 nights)
\$265/person	Per Diem (\$75 x2 days, \$60.00 x2 days [first/last])
\$550/person	Conference Registration Fees
\$85/person	Misc. (local transportation, tips, etc.)

e. Participant Support

None

f. Other Direct Costs

Materials

A total of \$5,811 (\$1,937 per year) is budgeted for purchasing some key materials, including autopilot, onboard CPU/GPU board, camera, IR sensor, LIDAR, motors, propellers, batteries, 3D printing materials, and soldering iron kits.

g. Direct Costs

Year 1: \$99,790

Year 2: \$102,578

Year 3: \$105,451

h. Indirect Costs

UTSA's Indirect Costs are calculated in accordance with the University's federally negotiated indirect cost rate agreement (Department of Health and Human Services), which is (b) (4) effective 9/1/2020 until amended. MTDC excludes equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, participant support costs and the portion of each subaward in excess of (b) (4) Note – UTSA is currently in negotiations for a new rate agreement; this version, however, remains valid until that negotiation is complete.

Year 1: (b) (4)

Year 2: (b) (4)

Year 3: (b) (4)

The University of Texas at San Antonio's fiscal year runs from September 1 to August 31. The University of Texas at San Antonio will consider the costs and requests in the justification approved if an award is made and no contrary guidance from the agency is included in the award notice.

NAME: Yongcan Cao

POSITION TITLE & INSTITUTION: Associate Professor, University of Texas at San Antonio

A. PROFESSIONAL PREPARATION - (see [PAPPG Chapter II.C.2.f.\(i\)\(a\)](#))

INSTITUTION	LOCATION	MAJOR/AREA OF STUDY	DEGREE (if applicable)	YEAR (YYYY)
Nanjing University of Aero. & Astro.	Nanjing, China	Instrumentation & Control	B.E.	2003
Shanghai Jiao Tong University	Shanghai, China	Control Theory & Engineering	M.E.	2006
Utah State University	Logan, UT	Electrical Engineering	Ph.D.	2010
Utah State University	Logan, UT	Electrical Engineering	Postdoc	2011
University of California, Riverside	Riverside, CA	Electrical Engineering	Postdoc	2012

B. APPOINTMENTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(b\)](#))

From - To	Position Title, Organization and Location
2021 - present	Associate Professor and Assistant Chair of Research, University of Texas, San Antonio, TX
2015 - 2021	Assistant Professor, University of Texas, San Antonio, TX
2016 - 2016	U.S. Air Force Summer Faculty Fellow, Munitions Directorate, Eglin Air Force Base, FL
2012 - 2015	National Research Council Research Associate, Aerospace Systems Directorate, Wright-Patterson Air Force Base, OH

C. PRODUCTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(c\)](#)) Products Most Closely Related to the Proposed Project

1. H. Zhan and Y. Cao, "Efficient Multi-objective Reinforcement Learning via Multiple-gradient Descent with Iteratively Discovered Weight-Vector Sets", Journal of Artificial Intelligence Research, vol. 70, pp. 319-349, 2021.
2. H. Zhan, Y. Cao, M. Cortez, A. Harris, "Proactive Data-driven UAV State Estimation via Online End-to-end Learning", AIAA SciTech Conference, 2020.
3. F. Tao, M. Cortez, Y. Cao, "Infrared Camera Assisted UAV Autonomous Control via Deep Reinforcement Learning", AIAA SciTech Conference, 2021.
4. H. Zhan, F. Tao, and Y. Cao, "Human-guided Robot Behavior Learning: A GAN-assisted Preference-based Reinforcement Learning Approach", IEEE Robotics and Automation Letters, vol. 6, no. 2, pp. 3545-3552, 2021.
5. D. Barron, P.V. Chakravarthy, R. Nagarkar, Y. Cao, W. Gao, "IMU-based Autonomous Solar Tracking System with Soft Actuators: A Machine Learning Approach", IEEE Conference on Control Technology and Applications, pp. 1172-1178, 2021

Other Significant Products, Whether or Not Related to the Proposed Project

1. E. Garcia, Y. Cao, and D. Casbeer, "Periodic Event-Triggered Synchronization of Linear Multi-Agent Systems with Communication Delays," IEEE Transactions on Automatic Control, vol. 62, no. 1, pp. 366-371, 2017.
2. Y. Cao and W. Ren, "Distributed Coordinated Tracking with Reduced Interaction via a Variable Structure Approach," IEEE Transactions on Automatic Control, vol. 57, no. 1, pp. 33-48, 2012.
3. Y. Cao, W. Ren, and M. Egerstedt, "Distributed Containment Control with Multiple Stationary or Dynamic Leaders in Fixed and Switching Directed Networks," Automatica, vol. 48, no. 8, pp. 1586-1597, 2012.
4. Y. Cao, W. Ren, D. Casbeer, and Corey Schumacher, "Finite-time Connectivity-Preserving Consensus of Networked Nonlinear Agents with Unknown Lipschitz Terms," IEEE Transactions on Automatic Control, vol. 61, no. 6, pp. 1700-1705, 2016.

D. SYNERGISTIC ACTIVITIES - (see [PAPPG Chapter II.C.2 f.\(i\)\(d\)](#))

- Proposal reviewer and panelist for NSF, DoD, NASA
- Co-chair of IEEE Technical Committee on Manufacturing Automation and Robotic Control
- Member of the IEEE Control Systems Society Conference Editorial Board (2013 - now) and IEEE Robotics and Automation Conference Editorial Board (2015-2017, 2021-now)
- Co-organized a few invited sessions for IEEE CDC and IEEE ACC
- Associate Editor for Automatica, 2022-

Current and Pending Project and Proposal Submissions

Name: Yongcan Cao

Current

1. Title: An Active Learning Approach for Precise and Reliable UAV Formation Maneuvers

Objectives: The objectives of the project are to overcome both theoretical and algorithmic challenges in developing an active learning approach that integrates physics-based and learning-based modeling and control methods.

Source and Amount of Funding: Office of Naval Research, Arlington, VA, \$452,267

PI's Effort: 1 month/year

Period of Performance: April 1, 2019 – March 31, 2023

2. Title: Optimal 3D Maneuvers for UAV Swarms

Objectives: The project focuses on three essential problems: (1) provable 2D cooperative turning maneuver design; (2) provable 3D cooperative rotational turning maneuver design; and (3) energy-efficient 3D cooperative turning maneuvers. The completion of the project will advance the practical autonomy of UAVs for Air Force missions in complex operation environments.

Source and Amount of Funding: Air Force Research Lab, Dayton, OH, \$200,000

PI's Effort: 0.5 month/year

Period of Performance: August 2, 2020 – August 1, 2023

3. Title: Human-guided Online Learning for Long-term Autonomy with Active Self Evaluation

Objectives: The project seeks to overcome technical challenges in the development of a human-guided online learning approach that integrates a newly designed stereo reinforcement learning and explainable multi-objective learning with human-guided learning to enable self online evaluation with need-based human queries.

Source and Amount of Funding: Army Research Office, Adelphi, MD, \$359,897

PI's Effort: 1 month/year

Period of Performance: March 14, 2021 – March 13, 2024

4. Title: SHARE: Shared Human-AI-Robot Ecosystem

Objectives: The objectives of the project are to (1) overcome some theoretical and algorithmic challenges of developing a human-AI-robot ecosystem that leverages human guidance to

address some unsolved challenges in reinforcement learning and (2) collaborate with Army Research Lab to develop tools/methods with applications in Army missions.

Source and Amount of Funding: Army Research Lab, Adelphi, MD, \$505,443

PI's Effort: 1 month/year

Period of Performance: October 1, 2021 – September 30, 2024

5. Title: REU Site: Artificial Intelligence Powered Robotics in 5G Network

Objectives: The objectives of the project are to provide research experiences for undergraduate students in the area of artificial intelligence, robotics, power systems, and 5G communication networks.

Source and Amount of Funding: National Science Foundation, Arlington, VA, \$403,354

PI's Effort: 0.1 month/year (senior personnel)

Period of Performance: April 1, 2021 – March 31, 2024

6. Title: A Systematic Study of Learning From Failure

Objectives: The objectives of the project are to develop a new “learning from failure” approach that focuses on providing theoretical and algorithmic solutions of reward and policy learning when the value of failure is explicitly harnessed.

Source and Amount of Funding: Office of Naval Research, Arlington, VA, \$502,051

PI's Effort: 1 month/year

Period of Performance: July 15, 2022 – July 14, 2026

Pending

1. Title: Bridging Gaps in Human, AI and Robotics for Realizable Human-guided Learning

Objectives: The objectives of the project are to overcome the two challenges, namely, the ability for robots to adaptively learn from diverse human guidance with limited human interaction and the training of next-generation workforce for NEEC with both technical and hands-on skills to apply the newly developed AI algorithms in simulated and real-world UAV platforms.

Source and Amount of Funding: NSWC IHD, Indian Head, MD, \$344,506

PI's Effort: 1 month/year

Period of Performance: April 1, 2023 – March 31, 2026

2. Title: An Active Learning Approach for Inclusive and Diverse Workforce in Autonomy and Artificial Intelligence

Objectives: The objective of the project is to develop a new active learning approach for inclusive and diverse workforce, with a focus on autonomy and artificial intelligence, that integrates students-oriented hands-on learning, problem-based learning, and human teaming effectiveness/dynamics learning with diverse STEM topics, namely, 3D printing, programming/software, hardware, human-computer interface, data science, autonomy, and artificial intelligence.

Source and Amount of Funding: ONR, Arlington, VA, \$461,730

PI's Effort: 1 month/year

Period of Performance: May 1, 2023 – April 30, 2026

References

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